



VERIFICATION OF TRANSLATION

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Japanese Patent Application No. 2002-321835

I further declare that all statements made herein of my own knowledge
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Ichitaro Ito



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[Title of the Invention]	MOBILE COMMUNICATION SYSTEM, BASE STATION, MOBILE STATION AND RADIO NETWORK CONTROLLER
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[Title of the Invention]

MOBILE COMMUNICATION SYSTEM, BASE STATION, MOBILE STATION AND RADIO NETWORK CONTROLLER

[Claim for a Patent]

[Claim 1]

A mobile communication system configuring a radio network controller, a base station, and a mobile station, and performing multicast communication, wherein the mobile station comprising:

 a response signal creator configured to create a response signal to a control signal for a multicast group;

 a response signal holder configured to hold the response signal for a predetermined duration; and

 a response signal transmitter configured to transmit the response signal after holding the response signal for the predetermined duration.

[Claim 2]

The mobile communication system of Claim 1, wherein;

 the base station configures a response signal relay configured to transfer response signals transmitted from the mobile stations to the radio network controller; and wherein

 the response signal relay transfers only a predetermined number of response signals to the radio network controller, and any following response signal is retained.

[Claim 3]

A base station supporting multicast communication, the base station comprising:

 a response signal relay configured to transfer response signals transmitted from a plurality of mobile stations to a radio network controller, the response signals responding to a control signal for a multicast group; and wherein

 the response signal relay transfers only a predetermined number of response signals to the radio network controller, and any following response signal is retained.

[Claim 4]

A mobile station supporting multicast communication, the mobile station comprising:

 a response signal creator configured to create a response signal to a control signal for a multicast group;

a response signal holder configured to hold the response signal for a predetermined duration; and

a response signal transmitter configured to transmit the response signal after holding the response signal for the predetermined duration.

[Claim5]

A radio network controller supporting multicast communication, comprising,

a response signal processor configured to perform a predetermined processing on a predetermined number of response signals or on a first response signal, transmitted from the mobile station, wherein the response signals respond to a control signal for a multicast group, and

the response signal processor configured not to perform processing on the response signal transmitted from any different mobile station after receiving the first response signal or the predetermined number of response signal transmitted from the mobile station.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a mobile communication system, a base station, a mobile station and a radio network controller which support multicast communication.

[0002]

[Prior Art]

As shown in FIG. 6, a broadcast communication whereby a plurality of base stations 11 to 17 transmit common information to unspecified mobile stations 101 to 112 in predetermined areas is known in a conventional mobile communication system. (For example; non-patent literature 1)

[0003]

In addition, as shown in FIG. 7, multicast communication whereby a plurality of base stations 11 to 17 transmit common information to specific mobile stations belonging to a specific group is known in a conventional mobile communication system. (For example; non-patent literature 2)

[0004]

[Non-Patent Literature 1]

3rd Generation Partnership Project Technical Specification Group
Terminals, 23.041 Technical realization of Cell Broadcast
Service(CBS), October, 2000

[0005]

[Non-Patent Literature 2]

3rd Generation Partnership Project Technical Specification Group
Radio Access Network, 25.324 Broadcast/Multicast Control BNC,
December, 2000

[0006]

[Problems to be Solved by the Invention]

However, there is a problem in that a plurality of mobile stations joining in a multicast group receive a control signal for the multicast group at approximately the same time, and a plurality of response signals are transmitted to the radio network controller at approximately the same time, so that the load on receiving controlling and processing of the radio network controller is increased as the number of response signals increases in the conventional multicast communication.

[0007]

In viewing of the foregoing, it is an object of the present invention to provide a mobile communication system, a base station, a mobile station and a radio network controller which can reduce the load on the radio network controller during multicast communication.

[0008]

[Means for Solving the Problems]

A first aspect of the present invention is a mobile communication system supporting a multicast communication, configuring a radio network controller, a base station and a mobile station. The mobile station is summarized as configuring a response signal creator configured to create a response signal to a control signal for a multicast group, a response signal holder configured to hold the response signal for a predetermined duration, and a response signal transmitter configured to transmit the response signal after holding the response signal for the predetermined duration.

[0009]

At the first aspect of the present invention, it is favorable that the base station comprises a response signal relay configured to transfer the response signals transmitted from the mobile stations to a radio network controller, and the response signal relay transfers only a predetermined number of response signals to the radio network controller and any following response signal is retained.

[0010]

A second aspect of the present invention is summarized as a base station supporting multicast communication. The base station comprises a response signal relay configured to transfer the response signals transmitted from the mobile stations to a radio network controller based on the control signal for multicast group. The response signal relay transfers only a predetermined number of response signals to the radio network controller and any following response signal is retained.

[0011]

A third aspect of the present invention is summarized as a mobile station supporting multicast communication, configuring a response signal creator configured to create a response signal to a control signal for a multicast group, a response signal holder configured to hold the response signal for a predetermined duration (for example, a random duration), and a response signal transmitter configured to transmit the response signal after holding the response signal for the predetermined duration.

[0012]

A forth aspect of the present invention is summarized as a radio network controller supporting multicast communication. The radio network controller configures a response signal processor configured to perform a predetermined processing on a predetermined number of response signals or on a first response signal, transmitted from the mobile station. The response signals respond to a control signal for a multicast group. Moreover, the response signal processor configured not to perform processing on the response signal transmitted from any different mobile station after receiving the first response signal or the predetermined number of response signal transmitted from the mobile station.

[0013]

[Embodiment of the Invention]

FIG. 1 shows the entire configuration of a mobile communication system according to an embodiment of the present invention.

[0014]

As shown in FIG. 1, the mobile communication system according to the embodiment comprises four base stations 10, 20, 30 and 40 under a radio network controller 50. In the mobile communication system according to the embodiment, the base station 10 manages mobile stations 11 to 13, the base station 20 manages mobile stations 21 and 22, the base station 30 manages mobile stations 31 and 32, and the base station 40 manages mobile stations 41 to 43.

[0015]

Herein, the mobile stations 11, 12, 21, 41, 42 and 43 are assumed to join in the same multicast group A in the embodiment.

[0016]

FIG. 2 shows a functional block diagram of the mobile station used in the radio communication system according to the embodiment. Functions of a plurality of mobile stations 11 to 43 are basically the same, so that the function of the mobile station 11 will be explained as follows.

[0017]

As shown in FIG. 2, the mobile station 11 is configured with a control signal receiver 11a, a response signal transmitter 11b, a response signal creator 11c and a holder 11d. The mobile station 11 can support multicast communication.

[0018]

The control signal receiver 11a is configured to receive a control signal for the multicast group A. The control signal for the multicast group A is transmitted from the base station 10.

[0019]

The response signal creator 11c is configured to create a response signal to the control signal for the multicast group A. In this embodiment of the invention, the response signal creator 11c configures the response signal to the control signal for the multicast group A.

[0020]

The holder 11d is configured to hold the created response signal for a predetermined duration; (for example, a random duration). In this embodiment of the invention, the holder 11d configures the response signal holder which holds the response signal for a predetermined duration.

[0021]

For example, the holder 11d can determine a random duration based on a number generated by a random number generator, or use a preset duration as the random duration.

[0022]

For example, the holder 11d of the mobile station 11 can be configured to hold the response signals for 300ms, the holder 11d of the mobile station 12 can be configured to hold the response signals for 500ms, the holder 11d of the mobile station 21 can be configured to hold the response signals for 900ms, the holder 11d of the mobile station 41 can be configured to hold the response signals for 200ms, the holder 11d of the mobile station 42 can be configured to hold the response signals for 800ms, the holder 11d of the mobile station 43 can be configured to hold the response signals for 500ms.

[0023]

The response signal transmitter 11b is configured to transmit the response signal to the base station 10 after holding the response signal for the predetermined duration. In this embodiment of the present invention, the response signal transmitter 11b configures a response signal transmitter which transmits the response signal to the base station 10 after holding the response signal for a predetermined duration.

[0024]

FIG. 3 shows a functional block diagram of the base station used in the radio communication system according to the embodiment. Functions of a plurality of base stations 10 to 40 are basically the same, so that the function of the base station 10 will be explained as follows.

[0025]

As shown in FIG. 3, the base station 10 supports multicast communication, and configures a control signal relay 10a and a response signal relay 10b.

[0026]

The control signal relay 10a is configured to receive a control signal from the radio network controller 50, and transmit the control signal to the mobile stations 11 and 12 joining in a specific multicast group (for example, the multicast group A) under the base station 10.

[0027]

The response signal relay 10b is configured to receive a response signal from the mobile stations 11 and 12 under the base station 10, and transmit the response signal to the radio network controller 50.

[0028]

The response signal relay 10b can be configured to transfer a predetermined number of response signals to the radio network controller 50. Any response signal following the predetermined number of response signals (any following response signal) is retained by the response signal relay 10b. The base stations can determine any number (for example, one, two and so on) as the predetermined number.

[0029]

FIG. 4 shows a functional block diagram of the radio network controller 50 used in the radio communication system according to the embodiment.

[0030]

As shown in FIG. 4, the radio network controller 50, supporting multicast communication, is configured with a control signal transmitter 51, a response signal receiver 52 and a response signal processor 53.

[0031]

The control signal transmitter 51 is configured to transmit the control signals for performing predetermined processing such as a service notice processing and an authentication processing to the base stations 10 to 40 in which the mobile stations 11 to 43 performing the predetermined processing exist.

[0032]

The response signal receiver 52 is configured to receive the response signals transmitted from the mobile stations 11 to 43 via the base stations 10 to 40. The response signal receiver 52 manages the number of response signals received from each mobile station.

[0033]

The response signal processor 53 is configured to perform a predetermined processing (for example, transmission of service data) in accordance with the response signals received by the response signal receiver 52.

[0034]

The response signal processor 53 can be configured to perform processing only on a predetermined number of response signals

transmitted from the mobile station 11. Any response signal transmitted from the mobile station 12 and following the predetermined number of response signals, can be unprocessed by the radio network controller 50.

[0035]

Referring to FIG. 5, the operation where the radio network controller 50 performs a predetermined processing (for example, a service notice processing, or an authentication processing) on the mobile stations 11, 12, 21, 41, 42, 43 joining in the multicast group A in the radio communication system according to the embodiment, will be described.

[0036]

In step 1001, the radio network controller 50 transmits a control signal such as a service notice signal and an authentication signal to three base stations 10, 20 and 40.

[0037]

In step 1002, each of the base stations 10, 20 and 40 (the base station 30 can be included) receives the control signal transmitted from the radio network controller 50. The control signals transmitted from each of the base stations 10, 20 and 40 (the base station 30 can be included) reach the mobile stations 11, 12, 21, 41, 42 and 43 joining in the multicast group under the base stations 10, 20 and 40 (the base station 30 can be included).

[0038]

In step 1003, each of the mobile stations 11, 12, 21, 41, 42 and 43 creates a response signal to the control signal for the multicast group, and holds the created response signal for a random duration.

[0039]

In step 1004, each of the mobile stations 11, 12, 21, 41, 42 and 43 transmits the response signal to the base stations 10, 20 and 40 after holding the response signal for the random duration.

[0040]

In step 1005, each of the base stations 10, 20 and 40 receives the response signal from each of the mobile stations 11, 12, 21, 41, 42 and 43, and transmits the received response signal to the radio network controller 50.

[0041]

Each of the base stations 10, 20 and 40 does not need to transfer next signals following a first response signal or a predetermined number of response signals received from the mobile stations 11,

12, 21, 41, 42 and 43, to the radio network controller 50.

[0042]

In step 1006, the radio network controller 50 transmits a service data to the base stations 10, 20 and 40, in accordance with the response signals received from each of the mobile stations 11, 12, 21, 41, 42 and 43. The radio network controller 50 can perform a predetermined processing on only a predetermined number of response signals transmitted from each of the mobile stations 11, 12, 21, 41, 42 and 43. In other words, any response signal following the predetermined number of response signals is unprocessed by the radio network controller 50. The radio network controller 50 can determine any number (for example, one, two and so on) as the predetermined number.

[0043]

In step 1007, each of base stations 10, 20 and 40 transmits the received service data to each of the mobile stations 11, 12, 21, 41, 42 and 43.

[0044]

The radio communication system according to the embodiment, even when common information is transmitted to a plurality of mobile stations like multicast communication or broadcast communication, can reduce the load on the radio network controller 50 caused by the response signals transmitted from a plurality of mobile stations 11, 12, 21, 41, 42 and 43, which reach the radio network controller 50 at approximately the same time, by spreading the time frame of the response signals transmitted from a plurality of mobile stations 11, 12, 21, 41, 42 and 43.

[0045]

[Effects of the Invention]

The present invention can provide a mobile communication system, a base station, a mobile station and a radio network controller used in a radio communication system which can reduce the load on the radio network controller during the multicast communication.

[Brief Description of the Drawings]

[FIG. 1]

FIG. 1 is a diagram for explaining entire mobile communication according to one embodiment of the present invention.

[FIG. 2]

FIG. 2 is a functional block diagram of a mobile station for the mobile communication system according to one embodiment of the present invention.

[FIG. 3]

FIG. 3 is a functional block diagram of a base station for the mobile communication system according to one embodiment of the present invention.

[FIG. 4]

FIG. 4 is a functional block diagram of a radio network controller according to one embodiment of the present invention.

[FIG. 5]

FIG. 5 is a sequence diagram showing the mobile communication system according to one embodiment of the present invention.

[FIG. 6]

FIG. 6 is a diagram for explaining broadcast communication according to the prior art.

[FIG. 7]

FIG. 7 is a diagram for explaining multicast communication according to the prior art.

[Description of the Reference Numerals]

10,20,30,40 base station

10a control signal relay

10b response signal relay

11,12,13,21,22,31,32,41,42,43 mobile station

50 radio network controller

51 control signal transmitter

52 response signal receiver

53 response signal processor

[Name of Document] ABSTRACT

[Abstract]

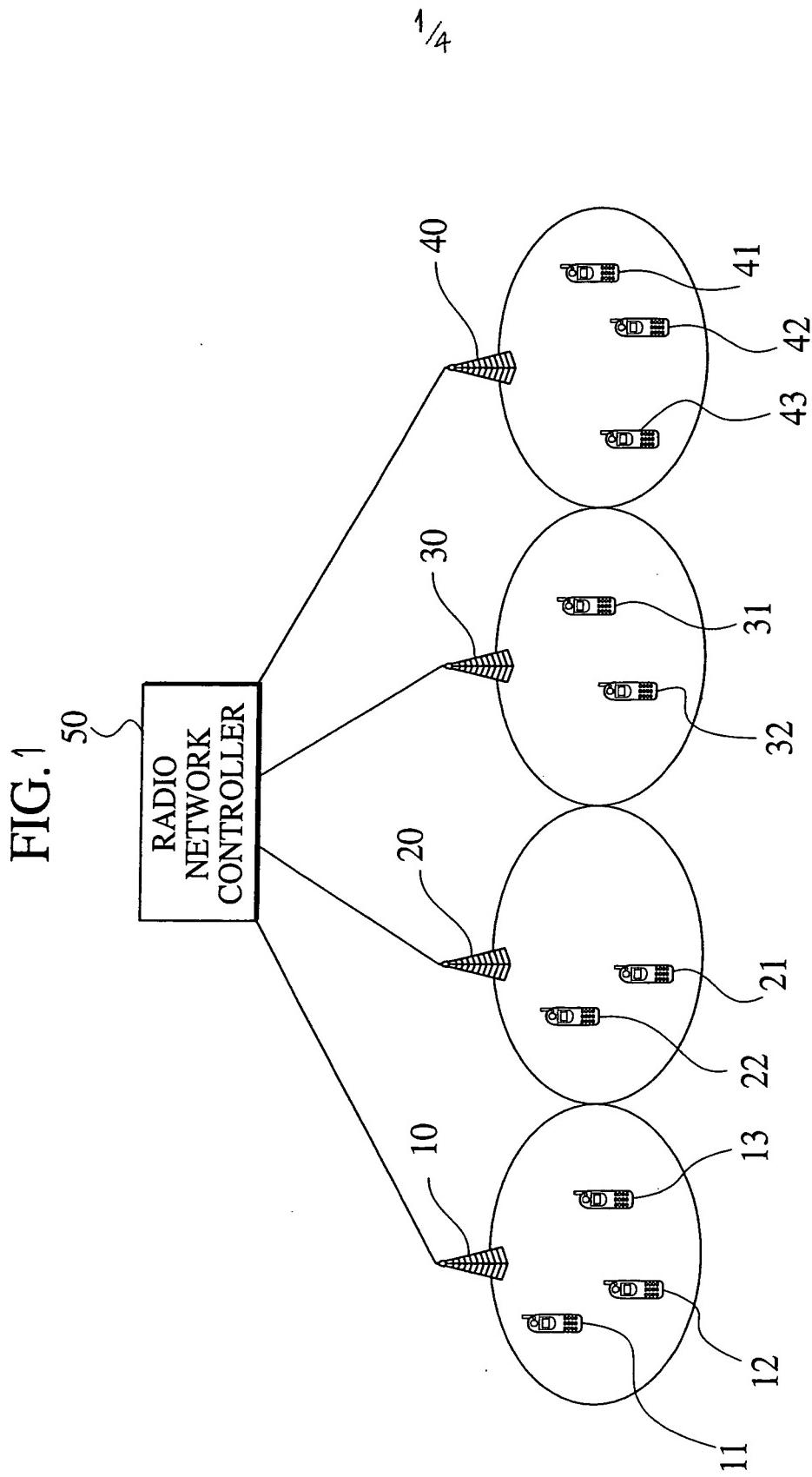
[Object]

The object of the present invention is to provide a mobile communication system, a base station, a mobile station and a radio network controller which can reduce the load on the radio network controller during multicast communication.

[Solving Means]

The present invention is summarized as a mobile communication system supporting multicast communication, configures a radio network controller 50, base stations 10, 20, 30, and 40 and mobile stations 11, 21, 41, and 42, wherein the mobile station includes a response signal creator 11c which creates response signal responding to a control signal for multicast group, a response signal holder 11d which holds the response signal for a predetermined duration, and a response signal transmitter which transmits the response signal after holding the response signal for the predetermined duration.

[Selected Figure] FIG. 1



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FIG. 2

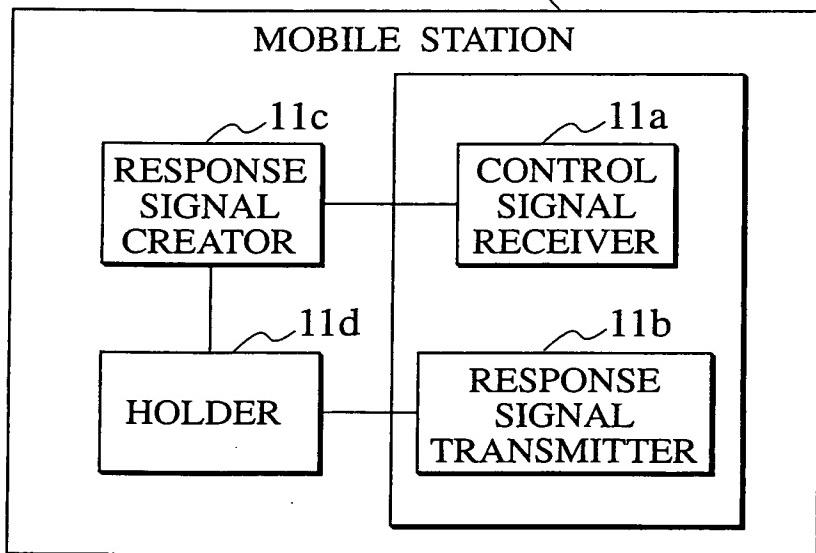


FIG. 3

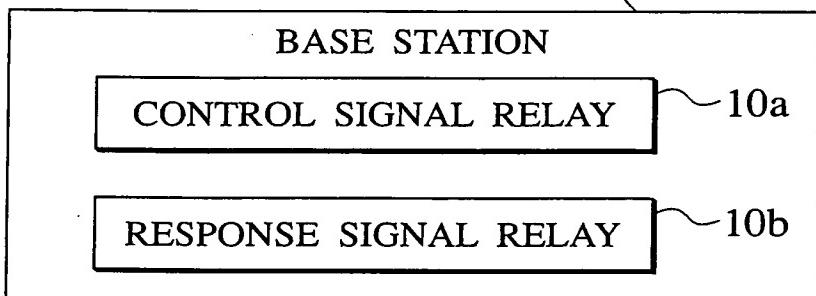
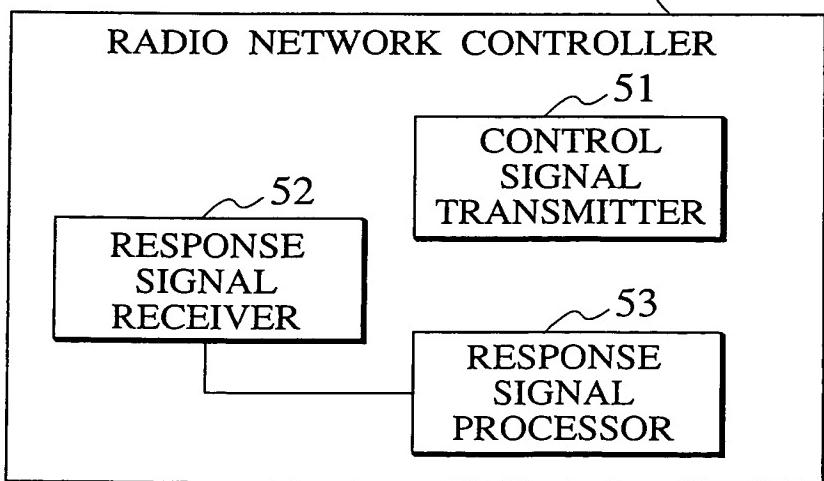
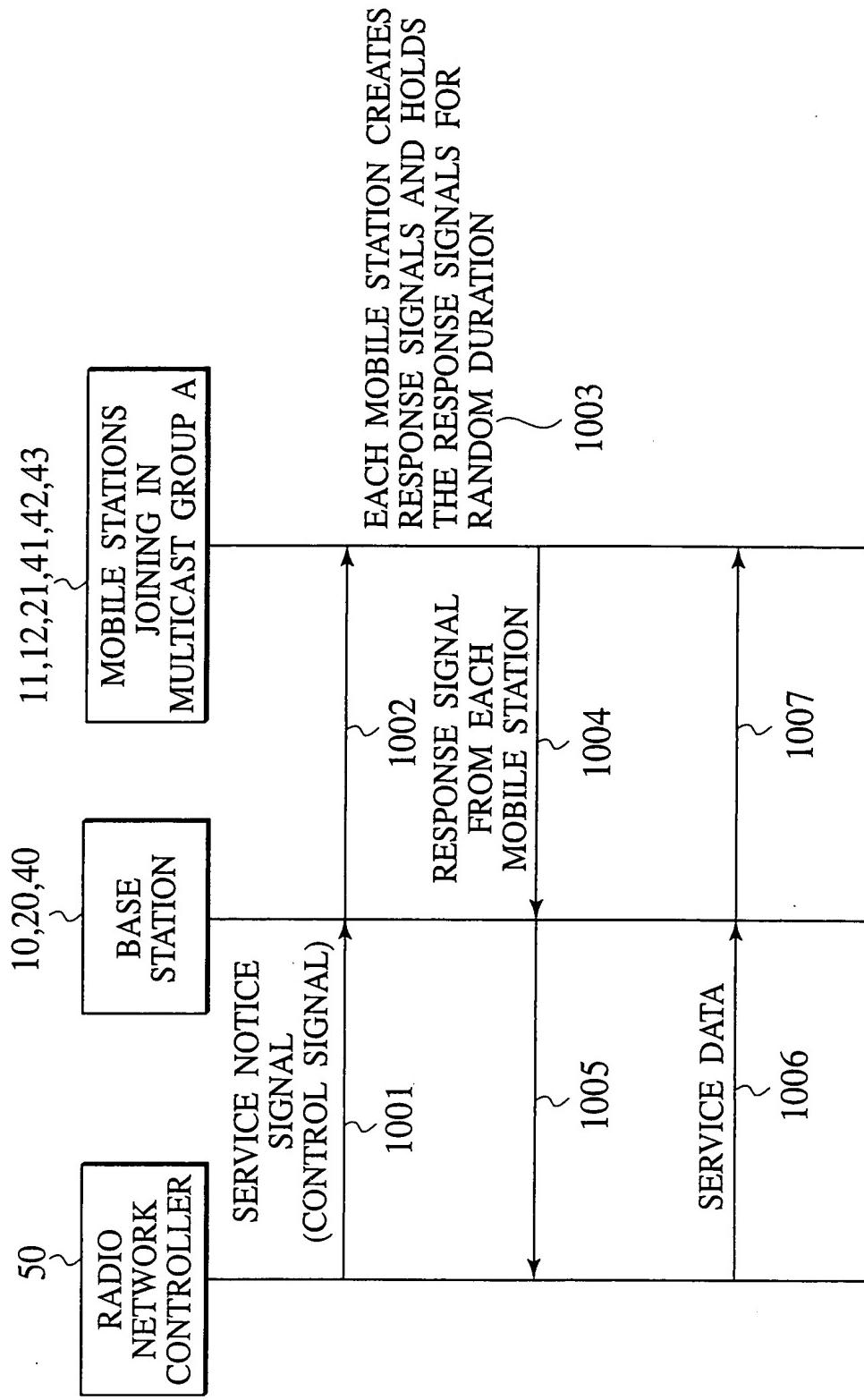


FIG. 4



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FIG. 5



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FIG. 6

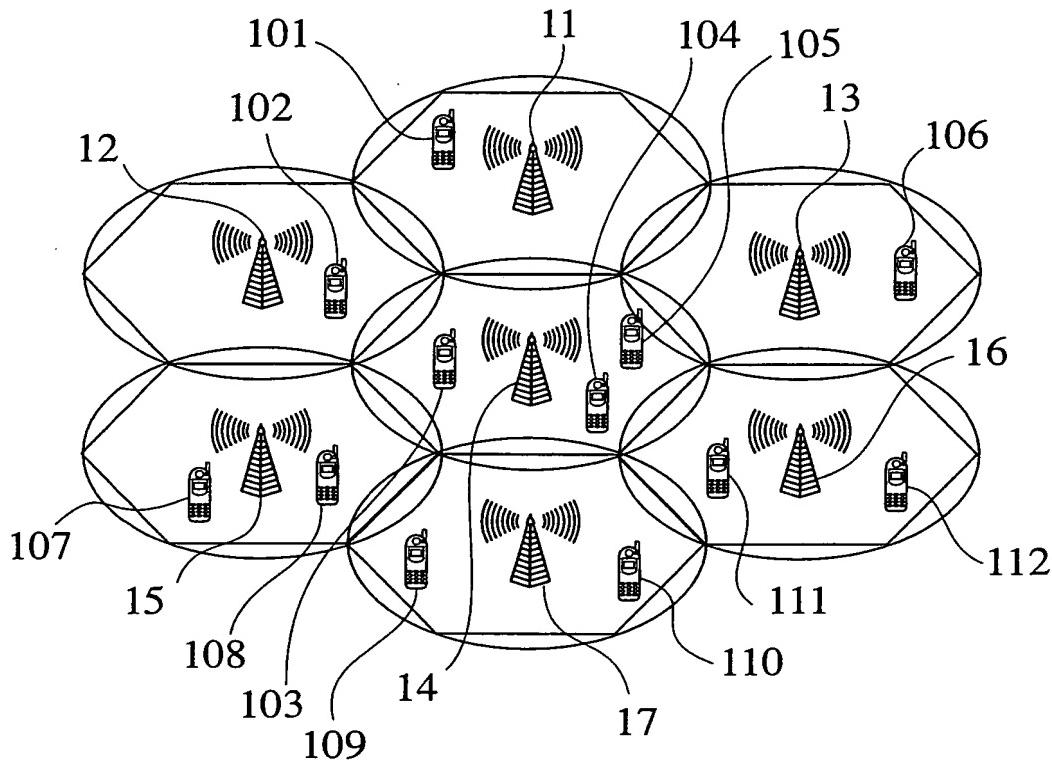


FIG. 7

